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18CHE12/22

First/Second Semester B.E. Degree Examination, June/July 2024
Engineering Chemistry

Time: 3 hrs.   Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. What are ion-selective electrodes? Explain the construction and principle of glass electrode.
   (06 Marks)
   b. Describe the constructive and working of Lithium-ion battery. Mention its applications.
   (07 Marks)
   c. An electrochemical cell consists of iron electrode dipped in 0.1 $FeSO_4$ and silver electrode dipped in 0.05M $AgNO_3$ solution. Write cell representation, cell reactions and calculate emf of the cell at 298 K. Given that the standard electrode potential of iron and silver electrodes are -0.44V and 0.8V respectively. **(07 Marks)**

OR

2 a. What is battery? Explain secondary and reserve battery with examples. **(06 Marks)**
   b. Describe the construction and working of Nickel – metal hydride battery. Give its applications. **(07 Marks)**
   c. What are electrolyte concentration cells? The emf of the cell

   Cu | $CuSO_4$ || $CuSO_4$ | Cu   is 0.0595 V at 298K. Find the value of X.
   (0.001M)   (X M)   **(07 Marks)**

Module-2

3 a. Define Corrosion. Explain the electrochemical theory of corrosion by taking iron as an example. **(07 Marks)**
   b. Explain how the following factors affecting rate of corrosion :
   i) Ratio of anodic to cathodic area   ii) pH of the medium   **(06 Marks)**
   c. What is electroless plating? Explain the process of electroless plating of Nickel.   **(07 Marks)**

OR

4 a. What is cathodic protection? Explain sacrificial anode and impressed current methods.
   (07 Marks)
   b. Explain briefly the following factors:
   i) Polarization of electrode   ii) Over voltage.   **(06 Marks)**
   c. What is electroplating? Explain the process of electroplating of chromium.   **(07 Marks)**

Module-3

5 a. Define HCV. Explain the experimental determination of calorific value of solid fuel using Bomb calorimeter. **(07 Marks)**
   b. What are fuel cells? Describe the construction and working of solid oxide fuel cell. Give its applications. **(06 Marks)**
   c. On burning 0.76×10^{-3} kg of solid fuel in a Bomb calorimeter, the temperature of 2.5kg of water is increased from 25°C to 28°C. The water equivalent of calorimeter and latent heat of steam are 0.486 kg and 2457 kJ/kg respectively. Calculate its HCV and LCV. Given specific heat of water = 4.187 kJ/kg/°C and percentage of hydrogen is 2.5. **(07 Marks)**

OR

6 a. Explain the preparation of solar grade silicon by union carbide process. **(07 Marks)**
   b. Illustrate the construction and working of PV cell. Mention its advantages and disadvantages. **(07 Marks)**
   c. What is Biodiesel? Explain the synthesis of Biodiesel with reaction and mention its advantages. **(06 Marks)**

Module-4

7 a. What are the main sources, effects and control of carbon monoxide pollution? **(07 Marks)**
   b. Define Biomedical waste. Mention its sources, characteristics and disposal methods. **(07 Marks)**
   c. Define COD. 25 cm^3 of waste water mixed with 10 cm^3 of $K_2Cr_2O_7$, acidified and refluxed. The unreacted $K_2Cr_2O_7$ require 15.2 cm^3 of 0.3N FAS. In a blank titration 10 cm^3 of acidified $K_2Cr_2O_7$ require 19.4 cm^3 of same 0.3N FAS. Calculate COD if waste water. **(06 Marks)**

OR

8 a. What is secondary air pollutant? Explain ozone depletion with reactions mention its effects and control measures. **(08 Marks)**
   b. What is desalination? Describe the purification of sea water by reverse osmosis process. **(06 Marks)**
   c. Explain the secondary and tertiary treatment of sewage. **(06 Marks)**

Module-5

9 a. Explain the theory and instrumentation of potentiometry. **(07 Marks)**
   b. Explain the instrumentation and applications of conductometry by taking following examples:
      i) Strong acid with strong base   ii) Weak acid with a strong base **(07 Marks)**
   c. Write a note on carbon nanotubes. Mention its applications. **(06 Marks)**

OR

10 a. What are nanomaterials? Explain the synthesis of nanomaterial by precipitation method. **(07 Marks)**
   b. Write a note on fullerenes. Mention its properties and applications. **(07 Marks)**
   c. Explain the theory and instrumentation of colorimetry. **(06 Marks)**

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